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SUCCESS IN SCIENCE[1]

MANY books have been written on success. How to be a successful salesman, how to be a successful author, how to be a successful this, that and the other. Very appealing are rules by which those who have not may hope to join the ranks of those who have. The higher the so-called civilization of a race or nation the greater the average desire of its individuals to get more than they have, to become more than they are.

In the strict sense success is the accomplishment of the attempted, but in the humanistic sense the thing attempted is taken into consideration. A criminal may be successful in committing a crime, or the miser may be successful in amassing treasure. But the generally accepted meaning of the expression, a successful man, includes something more than mere accomplishment. The accomplishment must be thought worth while by society. In our own civilization success has come to mean rather more than keeping ourselves and our families provided with the usual physical necessities of life, even though this may require a considerable degree of efficiency. The average man desires bodily comforts and makes an effort to obtain them. Having obtained them his efforts are confined in the main to maintaining his position. In a broad way we may say that the average man is satisfied to maintain himself and his family in average conditions for the society in which he moves. Such a man is successful in the sense that he has not failed; but the expression, a successful man, brings to mind accomplishment greater than that of maintaining the *status quo*. It is clear that a small portion of society is impelled by some inner force to go beyond the average and attempt to accomplish many things that are not required to satisfy physical wants.

We find at once that we are dealing with what are generally known as spiritual things. We are satisfying a spiritual rather than a physical or bodily need. The progress of the race is directly connected with this force. The reward obtained from material success is the joy of possession; the reward from spiritual success is the joy of achievement. The unthinking may assume that the successful man of business, the financial giant, is pushed on solely by his desire to possess material things. Far more probable is it that he is impelled by a desire to do

[1] Abridged from the address of the retiring president of the Washington Alumni Chapter of Phi Kappa Phi, May 12, 1925.

things. True, he may covet power, but the great constructive genius of the financial, political or religious world is certainly moved by a desire for more than material reward.

We all know how this joy of achievement emerges in all walks of life, distinguishing the exceptionally advanced from the mediocre. The artist obtains satisfaction from a picture well painted; the writer from an article well composed; the goldsmith from a vase well executed. The Great Teacher had spoken to the woman at the well, his disciples were hungry and asked him to eat. He answered, "I have meat to eat that ye know not of. My meat is to do the will of him that sent me and to accomplish his work." Here we have an example of spiritual power transcending bodily desires. In a degree this power is being manifested in all who accomplish results. There is a direct connection between success and the development of the will to do for the sake of doing. The successful man loves his work. Some men fail because they lack this mainspring of action. Others fail because the opportunity for expression is lacking; they are round pegs in square holes.

Scientists are an exceptional group, as the members have entered the group from choice. The artisan may be an engraver because his father was one before him. The business man may be the president of a bank because by accident he became a clerk in the institution when a boy.

The scientist has nearly always entered his group after an examination of conditions. He is usually, at least in this generation, a college graduate and hence is already in a selected class. Financial returns from scientific pursuits offer little attraction when compared with the possible rewards in commercial lines, and hence play little part in the selection of science as a calling. The percentage of successes among scientists is very high because of the free choice of that vocation. A man does best that which he likes. In speaking of high percentage we have in mind a comparison between scientific pursuits and other lines of activity, and by success we have in mind the average opinion of those who can appreciate accomplishment in the branch of human endeavor under consideration. Not all men adapted to scientific work become scientists, but those who have had the opportunity to choose science start out with a favorable handicap.

In estimating the percentages of success we should confine the term scientist to the research workers, to those who are engaged at least a part of their time in original investigation. A professor of science may be a successful teacher, even a great teacher, but most of us, I think, would not class these workers as scientists on this ground alone. The man who does research work does so in nearly all cases because he wants to. He can not carry on research without a rather extended period of preliminary training. We have, then, a class of trained workers with a love for and a desire to do the work they are doing. Success, at least in a moderate degree, follows as a matter of course. The characteristics which make for success are possessed by all of us to a greater or less degree. It is the fortuitous coincidence of a maximum development of several of these characteristics in one individual that produces the truly great scientist, an occurrence whose rarity follows from the laws of chance.

Success evidently depends upon two sets of things, ability and training. The successful man must be born with the first, but he can acquire the second.

The scientist's natural ability, imparted to him by his ancestors, includes many qualities necessary for success in other lines of human endeavor, such as physical soundness, and particularly the will to do. An outstanding characteristic of the exceptionally great scientist is his ability to correlate facts. From a mass of facts he distinguishes those that are related, those that are significant, those that open the door to further knowledge.

There are three stages in a research problem: first, establishing the facts; second, coordinating and correlating the facts in an orderly and coherent solution; third, publishing the results. Industry, patience and attention to detail are well recognized as necessary in establishing facts. It has been said that genius is the infinite capacity for taking pains. This is true, yet we all know that this is not enough. Most of us who have had experience in teaching are familiar with the occasional student who wishes to do original scientific work, but fails because he has no judgment as to relative values. All facts are equally important to him. He has energy and patience, and digs up a multitude of facts but does not know what to do with them. He has no skill in selection and coordination and fails to appreciate that facts are important chiefly as they can be related. Such students are not adapted to take up constructive work because they have no capacity for constructive thinking.

The scientific worker must divest himself of prejudice, and an important part of his training is to learn how to approach an investigation in a spirit of open-mindedness. The scientific attitude is not natural with most of us and must be brought about by a rather rigid system of training. I have shown in another place[2] that parental authority and school dis-

[2] "Remarks on the scientific attitude," SCIENCE, 59: 476, 1924.

cipline are opposed to the development of the scientific attitude, since in the main the child is taught to respect authority and to think as others think. Early training is very persistent and it is not easy to throw off the effects of early influences, but unless we do we can not succeed in a search for truth. It is well for the scientist to examine his own mental machinery at intervals during the investigation of a problem to see that it is running smoothly and according to plan.

Some men show great ability in the first part of the problem, the investigation and establishing of facts, but fail to carry through to the end. Interest is stimulated by discovering new things, but this interest lags in the drudgery of assembling the facts for permanent record. Some brilliant men fail to attain success in proportion to their brilliancy, because they can not hold themselves to the task of preparing and publishing results. A worker owes it to science and to his colleagues that he complete his investigations by presenting a carefully prepared résumé for record. The scientist's ability is judged in part by his publications. Some men, knowing this, hasten to place on record a large number of papers without much regard to the quality. Scientific work can not be hurried and the scientific world can not be misled by a voluminous output of printed matter if this is lacking in quality. There is another class whose standard is so high that the problem set is difficult to work out to completion by the average investigator. One of this class may work for years, even for a lifetime, delaying publication until every possible ramification is explored and every detail completed. Such a one may be doing work of the highest excellence, but has failed sufficiently to take into consideration the element of time. His results do not become available until published, and his delay withholds the essentials from the scientific world unnecessarily long. In some cases excellent work is lost because the worker has passed off the stage before completing his record by publication, and seldom are his notes sufficiently complete to permit publication by another. Our advice to this class would be to bring together a coherent part of the work and publish the results within a reasonable time.

Another class holds back the publication of important work through over-caution or timidity, because of a few minor deficiencies, which have little bearing on the conclusions. The worker should pass careful judgment on the bearing of the missing data, but the element of time should be given due weight. Our advice here would be to round out results and publish, stating frankly the deficiencies.

Our model for a well-balanced judgment on the relation of time and publication is the example of Darwin and his 20 years' investigation leading up to the publication of his epoch-making "Origin of Species," a masterpiece from the gathering of the data, through the correlation of the facts, to recording of the results. If he had published too soon, his work would have been ineffective. There was required the coordination of a great mass of detail, and the results could not be presented in installments. On the other hand, to have waited until all data could be gathered and incorporated would have delayed publication indefinitely. There is in effect a maximum in the curve of effectiveness in such matters. The law of diminishing returns is applicable. It is a mark of greatness to be able to estimate properly when the maximum has been reached.

We have passed in review those who have the will to work but lack the capacity, and those who have both the will and the capacity. We may pause a moment to mention a small class who have the capacity but lack the will. They are always going to do something. The alleged reason for the paucity of published results is the necessity for clearing up doubtful points which are never cleared up or for performing further experiments that are never performed. For such there is no hope, for the scientific spirit is wanting. Others may have produced meritorious work in their younger days but grow contented and for a while at least live upon the reputation of their earlier successes. For these there is some hope, as the scientific spirit is present but not functioning, and they may be galvanized into action by sufficient pressure from without.

The true scientist is rather cautious in his assertions concerning scientific facts and theories. His statements are modified by ifs, ands and buts. The teacher is prone to fall into the pedagogic custom of bolstering his prestige by making categorical statements. It requires a certain amount of courage to state to a student, "I do not know," or to shake his faith by calling attention to the limitations of our knowledge. The inexperienced teacher of science may not know whether he ought to know the answer to a certain question or whether the answer is not fully known to science. We may well be suspicious of the scientist who is uniformly definite in his answers to his students and may have ground for greater faith in the one who frankly modifies his answers with reservations. Personally, I have more confidence in a physician who sometimes admits that he is puzzled than I do in the one who always knows everything. Why should a physician know more about his subject than I do about my specialty? I am faced with puzzles all the time.

When we review our knowledge we may well be astonished how much of it is an approximation or is based on probability. What is the ratio of the side to the diagonal of a square? We do not know—that is to say, we do not know exactly. It is as 1 to the square root of 2. As our system of notation is not adapted to determine exactly the square root of 2 our answer can never be exact. What is the ratio of the diameter to the circumference of a circle? We can never know this exactly. We can show that the answer lies within certain limits and by laborious processes we may reduce these limits, but never can we reduce them to zero. We wish to know the length of a certain line. We measure it, that is, compare it with a known standard of length. We measure carefully and repeatedly, but our results do not agree. We can never know the exact length of the line. The best we can do is to obtain a most probable length and state that this result is probably true within certain limits of probable error. We are confronted with this situation in all our scientific research in so far as it involves physical measurements. In fact, the only cases in which we can express physical relations with exactness is in the realm of spiritual things. We can assert with certainty that the whole is equal to the sum of all its parts, but we are unable to demonstrate this by actual measurements.

Turning abruptly to another aspect of our subject, how much and how soon should a scientist specialize? When a student starts out with the intention of doing research, that is, original investigation, he finds himself within an immense globe of knowledge. He wishes to add knowledge, to crystallize the known from the unknown by accretion at the periphery. He must make his way through the great mass of the known in order to reach the boundary which separates this from the unknown. He may make his way more quickly by cutting a straight narrow path to the surface. But in this case his additions can be over a surface no larger than the cross-section of his path. The wider the path the better equipped is he for research. How wide should the path be for maximum efficiency?

That the scientist should specialize is generally admitted, and I shall not present proofs. But how soon should one specialize? Since I am not developing this subject as a major theme, I will merely give my opinion. I believe every intelligent worker should have a general education, that he should have the opportunity of coming in contact with all the great branches of knowledge and of human endeavor. Assuming that he is free to develop along normal lines and is not forced by financial necessity to modify an optimum plan, the student should diversify his learning until he feels a special interest in certain branches. In a general way he should follow his inclinations. In the university he may include the branches which are especially attractive, but should not yet confine himself to any narrow specialty. What is usually called specialization in his studies would normally take rather definite shape at the beginning of his post-graduate work. If he has developed a liking for scientific research he would concentrate more and more on a particular science. Finally he may attain eminence in a very restricted field of a single branch of science. However, I believe the best results are obtained by maintaining an intelligent contact with a much broader field than the one in which he specializes. There are two important reasons for this. First, the specialist should be in a position to adapt to his own use in his specialty all relevant knowledge developed in other lines. This he can not do unless he keeps in touch, at least in a general way, with discoveries in all branches. Second, man does not live by bread alone, that is to say, there is mental enjoyment and stimulation in following the work of others, and these momentary vacations react on his efficiency in his own line. The contact with general knowledge must be continuous even though more and more general as the years go by, otherwise breaks will occur which the specialist never has time to bridge. I would say, then, develop first a broad general knowledge, then specialize, but maintain contact with developments in other lines.

Assuming that the research worker has laid a broad foundation and has chosen a field in which to specialize he becomes familiar with the known in that field and finally attacks the unknown. Assuming that he has normal health and is not subjected to diverting pressure from unusual family or social distractions, his efficiency in research increases in geometrical ratio. His physical and mental endurance begins to wane in middle life, but his curve of scientific output continues to ascend for some time because of his accumulating knowledge and experience, and the maximum of the curve is reached only when there is a marked falling off of his strength due to advancing age. When is a scientist old? So long as his mind is directed forward, so long as his past achievements are to him incidental, so long as he is thinking of what he is going to do instead of what he has done, he is young. When he begins to emphasize those things that have been accomplished, when his mind is facing the past instead of the future, he is getting old. Some men get old at an early age.

A. S. HITCHCOCK

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WASHINGTON, D. C.

THE RELATION OF THE RESTRICTED TO THE GENERAL THEORY OF RELATIVITY AND THE SIGNIFICANCE OF THE MICHELSON–MORLEY EXPERIMENT

THE SIGNIFICANCE OF THE VELOCITY OF LIGHT IN THE GENERAL THEORY

IT is customary to regard the restricted theory of relativity as contained in the general theory as a special case applicable to regions far removed from matter. On this line of thought the quantity c, the velocity of light, makes its appearance very early in the discussion of the general theory, and with the status which it derives from the restricted theory. This results in an apparent dependence of the general upon the restricted theory which is much stronger than the exigencies of the situation would require. For this reason the following line of approach may have some advantages.

The analysis of course follows the well-known lines, all that is here attempted being a modification of the places where emphasis is placed on certain matters. We start with the Einstein equations

$$G_{\mu\nu} = 0 \qquad (1)$$

representing the vanishing of the contracted Riemann-Christoffel tensor. The problem is to find a solution of these equations for the $g_{\mu\nu}$ which will cause the law

$$\delta \int ds = 0 \qquad (2)$$

or, what is the same thing, the set of equations

$$\frac{d^2x^a}{ds^2} + \left\{ \mu\nu \cdot a \right\} \frac{dx^\mu}{ds} \frac{dx^\nu}{ds} = 0 \qquad (3)$$

to lead to results consistent with the facts of planetary motion.

The Schwarzschild solution of (1) for symmetry about a point[1] gives $g_{\mu\nu}$'s which make the line element of the form

$$ds^2 = -\gamma^{-1}dr^2 - r^2d\theta^2 - r^2\sin^2\theta d\varphi^2 + c^2\gamma dt^2 \qquad (4)$$

where

$$\gamma = 1 - \frac{2m}{r} \qquad (5)$$

m is a constant; and, as far as the requirement that the g's shall be solutions of (1) is concerned, c can be any constant whatever.[2] In the customary demonstrations the units in which dt is measured are supposed chosen in such a way that c^2 is unity. In order to emphasize the salient features appropriately, however, we have retained the c; for, if the method of measuring dt is provisionally assigned, the value of c becomes automatically determined by the condition imposed by planetary motion.

Following the usual procedure[3] of building up the equations of motion from (3), we arrive at

$$\frac{d^2u}{d\varphi^2} + u = \frac{m}{h^2} + 3mu^2 \qquad (6)$$

$$r^2 \frac{d\varphi}{ds} = h \qquad (7)$$

where $u = 1/r$ and h is a constant for the orbit. Integrating (6), with approximations for convenience (though not of necessity) we arrive again, in the usual way, at

$$u = \frac{m}{h^2}(1 + e\cos(\varphi - \omega - \delta\omega)) \qquad (8)$$

where e and ω are constants for the orbit, but

$$\delta\omega = \frac{3m^2}{h^2}\varphi \qquad (9)$$

Apart from the small term $\delta\omega$, an examination of the orbit would serve to determine only m/h^2, and not m and h separately. The term $\delta\omega$, however, serves to fix (m^2/h^2), so that by its inclusion both m and h are determined from experimental observations. The determination of h serves to determine dt/ds for any particular method of measuring dt. For, (7) is equivalent to

$$r^2 \frac{d\varphi}{dt}\frac{dt}{ds} = h \qquad (10)$$

and since ds is given by (4), and m and h are known, the value of c necessary to correspond to the facts can be evaluated.[4] Without knowledge of h it would be impossible to utilize (10) to determine c. The quantity c thus finds its natural origin in the departure of the motion from the Newtonian law, and it plays no part in the expression of the principal part (the Newtonian part) of the motion.

But there is something else. The quantity c represents the maximum velocity (in the sense defined by

$$\sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2}\Bigg)$$

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[1] See, for example, Eddington's "The Mathematical Theory of Relativity," pp. 82–85.

[2] For the benefit of those who are not specialists in the subject and who, on referring to Eddington's book, for example, find the c^2 here referred to missing, it will be sufficient to call attention to the fact that its inclusion will leave the $g_{\mu\nu}$'s, as given by (4) with (5) solutions of (1), as may readily be seen by checking through the analysis, or, more obviously, by observing that the inclusion of c^2 merely amounts to a change of the units in which dt is measured.

[3] See Eddington, *loc. cit.*

[4] Formally, both m and h are necessary for the purpose since ds involves m through γ. As a matter of fact both m and h are available, but practically speaking it would be sufficient to determine c from (10) by writing $ds^2 = c^2dt^2$.

which any planetary particle can attain. This will probably be sufficiently observed from the fact that for all values of ds^2 greater than zero, (4) gives

$$dr^2 + r^2d\vartheta^2 + r^2\sin^2\vartheta d\varphi^2 < c^2dt^2$$

since $\gamma < 1$. The fact may be proved more formally and generally, but in view of customary recognition of its truth we shall not elaborate further on the proof.

The existence of a maximum value c for the velocity attainable by a particle reminds us of the statement that no particles can move faster than the velocity of light, so we are tempted to inquire whether the velocity of light (understood as measured far from matter, of course) will serve for the quantity c, which had its origin in the deviations from the Newtonian law of planetary motion. We find that the velocity of light will so serve.

Again, since the maximum velocity which a particle can attain is equal to the velocity of light, we are tempted to try whether a ray of light will follow the path of a particle which (at infinity of course) travels with the velocity of light. In this way we are led to the idea of the bending of light by the sun in a manner which may appear more suggestive to some than one which leads to it through the Principle of Equivalence.

THE RELATION OF THE RESTRICTED TO THE GENERAL THEORY

At an infinite distance from matter, the line element (4) assumes the form

$$ds^2 = -dr^2 - r^2d\vartheta^2 - r^2\sin^2\vartheta d\varphi^2 + c^2dt^2$$

Or, in rectangular coordinates

$$ds^2 = -dx^2 - dy^2 - dz^2 + c^2dt^2 \qquad (11)$$

It is now a matter of algebra that the quantity ds given by (11) is invariant under the Lorentzian transformation

$$x' = \beta(x - vt)$$
$$y' = y$$
$$z' = z$$
$$t' = \beta\left(1 - \frac{v}{c^2}x\right)$$

$$\beta = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This does not necessarily carry with it the restricted theory in the sense that observers moving relatively to each other with constant rectilinear velocity will automatically adopt systems of measures related by the Lorentzian transformation. Nor does it imply that the laws of nature are necessarily invariant under that transformation, except in the spirit of the general theory itself, which calls for an expression of the laws in a form invariant under *any* transformation—a requirement which concerns itself with a different mode of expression of the laws, however—one of wider generality and therefore one aiming toward a less specific expression than that contemplated in the restricted theory. In fact, the general theory can stand without the restricted theory used in the foregoing senses.

The symmetry of the line element at infinity (as elsewhere) follows, of course, from the fact that a symmetrical solution of (1) was sought intentionally; and, it would follow that any one, who as a result of infinitely accurate measurements found the line element (4) satisfactory in its expression of the g's as functions of his coordinates near the center of symmetry and on out therefrom, would automatically be driven to the conclusion that far from the center of symmetry that line element assumed (again in terms of his coordinates) the form (11). By carrying over to this limiting case the law $\delta \int ds = 0$ for the path of a ray of light, he would be led to conclude the constancy of the velocity of light in all directions at infinity. However, a transformation[5] of coordinates from the r, ϑ, φ, of equation (4) to coordinates r′, ϑ', φ', differing from there by terms of the order v^2/c^2 (where v is a quantity of the order of magnitude of what, in pre-relativity days, was regarded as the earth's absolute velocity) would produce a departure from symmetry in the line element, which would only react on the equations of planetary motion deduced from (3) to an extent which was almost immeasurably small.[6] A line element of this type would revert at infinity to a form which differed from the symmetrical form by terms of the order v^2/c^2. It is of course true that the set of coordinates in terms of which the unsymmetrical line element is expressed, which set we shall call set B, is transformable (but not by the Lorentzian transformation) into the set A in terms of which the line element at infinity assumes the form (11); but it might be that our actual measures correspond to the set B and not to the set A. In this case, the law $\delta \int ds = 0$ for a ray of light would not lead to equal velocities in all directions, even at infinity.

[5] We do not wish to assume a *Lorentzian* transformation.

[6] Before the days of general relativity, expressions involving v^2/c^2 (where v is here the relative velocity of the sun and a planet) were deduced on the basis of the restricted theory of relativity. They gave results differing from the Newtonian results by amounts in general beyond the limits of observational error (see paper by de Sitter, Monthly Notices of Roy. Astr. Soc., Mar., 1911, p. 388). The largest effect, that concerned with the perihelion motion of Mercury, amounted to only 7 seconds of arc per century, and this was for a magnitude of v corresponding to the relative velocity of Mercury and the sun, a magnitude considerably greater than the values of v under discussion in the Michelson and Morley experiment. The effect of v on the bending of light by the sun would be, of course, entirely negligible.

Now, even as regards the restricted theory itself, the point of most important significance has but little to do with how the measures of different observers are related to each other. Its import lies rather in the assertion that the laws of nature far removed from gravitational fields are such that there is *some* system of coordinates in which they can be expressed in a form which will remain invariant for any transformation of coordinates of the Lorentzian type. The test here involved is a matter of algebra and has nothing to do with the question of whether an observer would automatically assume one set of the group of coordinate systems in terms of which the laws were invariant for the Lorentzian transformation. Now it might happen that when expressed in terms of the coordinates A the laws were invariant under the Lorentzian transformation. In this case, if they were correctly expressed in terms of the set B, they would not be invariant under this transformation. In the set of coordinates B we should not find the velocity of light the same in all directions. Our theory of the phenomena, expressed in these coordinates, would not predict it. In the set A we should find the velocity the same in all directions, and, in this set, or in all sets derivable from it by a Lorentzian transformation, we should have the features of the restricted theory which are of most value, the features which make this very criterion of invariance a test of the validity of a law. This frame of reference, in which the set of coordinates used by the observer was the set A, would serve as an absolute system of coordinates.[7]

Now, if the set of coordinates B happened to differ but little from the set A, it would follow that the laws of motion expressed in terms of B would be very approximately, though not exactly, invariant under a Lorentzian transformation (a mathematical transformation, not a physical change of measures). They would only be in error to the extent corresponding to the substitution of the coordinates of the B set in place of those of the A set, and the difference between the A and the B set would only amount to the almost immeasurably small difference which would correspond to magnitude of the effect which was anticipated in the Michelson and Morley experiment in pre-relativity days. While the effect of this difference would be enhanced when the substitution of the coordinates was made, for example, in the law of motion of a particle for a case when it was traveling with velocity nearly equal to that of light, the effect would always be far less than that resulting from the unavoidable errors in the measurements.

To summarize the situation, it may be said that on the above views the structure of such laws of physics as the laws of electrodynamics, carrying with them as they do invariance under the Lorentzian transformation for their own case, would continue to have full significance in implying such invariance for all the laws of physics when expressed in terms of a suitable coordinate system. The only new element in the line of thought lies in the possible belief that the actual coordinate systems which we use differ slightly from those in terms of which the laws should be expressed for their exact truth, the difference being so small as to have failed to cause us to detect that these laws were not quite true in terms of our coordinates except when, as in the case of the Michelson and Morley experiment, the test can be made with such precision as to make the difference between the two sets of coordinates play a vital part.

On the above line of thought the significance of the restricted theory would thus lie in the statement that there exist systems of coordinates in terms of which, far removed from matter, the line element assumes the form (11), and the *forms of the laws* of nature, when expressed in terms of these coordinates, are invariant for that type of transformation (the Lorentzian transformation) which leaves the *form of the line element invariant.*

Much of the foregoing discussion is of course prompted by the recent experiments of Professor D. C. Miller, in which a positive effect is claimed for the Michelson and Morley experiment. The object here is not to attempt any discussion of these experiments themselves. Much is undoubtedly to be said from the standpoint of possible effects which might be classed under normal disturbing influences; but it is hardly appropriate to discuss this feature before the experimental results have been published in full. The object here is simply to consider the status of the restricted theory of relativity if it should turn out that a positive effect remains in this experiment and in the various other experiments which have been performed to test the theory of relativity, after all disturbing effects (in the ordinary accepted sense of the term) have been removed. The attempt has been made to make the discussion in terms of the concept of a difference between the actual coordinate system used, and an ideal system in terms of which, with its related transformed systems, the laws of nature might be correctly expressed in a form invariant under the Lorentzian transformation. The fact that Professor Miller finds results which depend upon the altitude of the apparatus[8] would necessitate the assumption

[7] It might happen that by changing the motion of the system of measures B we could make them revert automatically to the system A. In this case we could define a meaning to an absolute velocity of the system B.

[8] Results which it is difficult to harmonize with Professor Michelson's experiment on the independence of ether drift on altitudes, *Amer. Jour. Sci.*, No. 3, p. 475, 1897.

that the measuring system also depends upon proximity to the earth's surface.

W. F. G. SWANN

SLOANE LABORATORY,
YALE UNIVERSITY

A YEAR OF PROGRESS FOR ORGANIZED MUSEUMS

Two years ago The American Association of Museums secured pledges amounting to nearly $30,000 annually for three years, and established at Washington national headquarters which subsequently were removed to New York City. The work has advanced rapidly as indicated by the report for the year just closed—the second year of operations—which shows income of $120,000.

The short period which has elapsed since the enlarged program was undertaken has witnessed development of the various services which were projected at the outset, but experience has served to shift a part of the emphasis from service to independent researches and promotions. A number of such projects have been planned and financed successfully, and some have already been brought to completion. The most significant elements of the year's progress are felt to be such pieces of work that can stand alone.

THE YOSEMITE MUSEUM

An outstanding accomplishment has been the building of a museum in Yosemite National Park. In June, 1924, the association's Committee on Museums in National Parks made application to the Laura Spelman Rockefeller Memorial for a grant to make possible the erection of a museum building in Yosemite Valley, and also to provide for installation of exhibits and staffing of the museum for three years, during which period its maintenance might be absorbed by the government. At the same time a small sum was requested for an investigation of museum needs in other national parks and the development of a comprehensive program.

On July 11, the memorial voted $70,500 for building, equipment and maintenance, and appropriated an additional $5,000 to the committee for its own work. Dr. Hermon C. Bumpus as chairman of a sub-committee made a trip to California and under his general supervision the work has been carried forward at so rapid a pace that within ten months the building has been completed and the preparation of exhibits far advanced.

REPORTS OF EUROPEAN SURVEYS

Director Charles R. Richards has completed a report of a survey made last year of industrial museums in Europe. The manuscript is in the hands of the publisher and will appear as a book entitled "The Industrial Museum." During the year, situations have developed in New York City and Chicago that promise early opportunities to apply the results of this study.

A report on industrial art museums in Europe, another investigation which was made last year by Professor Richards, is well advanced.

PROMOTION OF SMALL MUSEUMS

During the year Mr. Coleman has made three field trips which have enabled him to visit more than 200 museums in 85 cities in 24 states, from coast to coast and from Canada to Mexico. This survey was made possible by a grant from the Carnegie Corporation of New York and its purpose was to determine the conditions of museums in small communities.

This field work made plain the need for a comprehensive handbook of museum methods. Accordingly the secretary undertook the preparation of such a book, and the manuscript is now practically complete. The "Manual for Small Museums" will appear shortly as a book of some 45 chapters.

The development of this work has served to crystalize a program for the promotion of small museums, and has also offered many opportunities for local service.

FINANCING OF NEW PROJECTS

Five new undertakings have received grants during the year. The General Education Board appropriated $21,000 for the expenses of an official commission to the International Exposition of Industrial and Decorative Arts which is now being held in Paris, $10,000 to bring back from the exposition and to exhibit in the principal museums of this country a representative collection of the finest examples of European decorative and industrial art and $1,000 to develop and circulate collections of the best examples of American textiles, ceramics and other objects of industrial art. The Carnegie Corporation of New York has appropriated $1,500 for publication of the "Manual for Small Museums" and $2,500 for a study of museum fatigue.

The above-mentioned commission to Paris was appointed by Secretary of Commerce Hoover, with Director Richards as chairman. The study of museum fatigue has been placed in the hands of Professor Edward S. Robinson, of the University of Chicago, who has developed the outlines of an investigation to be carried forward with the help of the Art Institute of Chicago.

COMMITTEE WORK

Besides the Committee on Museums in National

Parks, to which reference has already been made, other committees which have been active are those on ethics, finance and accounting, and fire hazards.

The final report of the committee on ethics has just been adopted by the association and will issue shortly as a "Code of ethics for museum workers." The chairman of the committee was Harold L. Madison.

St. Louis Meeting

The beginning of a new fiscal year was marked by the twentieth annual meeting of the association, held in St. Louis from May 17 to 21. On that occasion the membership of the governing body, the council, was increased from ten to thirty by constitutional amendment in order to make possible a representation of the museum interests of the country both geographically and with respect to subject.

The members of the council as just constituted are: S. A. Barrett, Milwaukee; Laura M. Bragg, Charleston; William Alanson Bryan, Los Angeles; Hermon C. Bumpus, Buffalo; Harold T. Clark, Cleveland; William Sloan Coffin, New York; Thomas Jefferson Coolidge, Boston; John Cotton Dana, Newark; Barton W. Evermann, San Francisco; Chauncey J. Hamlin, Buffalo; Robert B. Harshe, Chicago; William M. Hekking, Buffalo; Archer M. Huntington, New York; Frank Logan, Chicago; Richard Swann Lull, New Haven; J. Arthur MacLean, Indianapolis; John D. McIlhenny, Philadelphia; Charles B. Pike, Chicago; George D. Pratt, New York; C. G. Rathmann, St. Louis; William deC. Ravenel, Washington; Paul M. Rea, Cleveland; Paul J. Sachs, Cambridge; Samuel L. Sherer, St. Louis; George M. Stevens, Toledo; Douglas Stewart, Pittsburgh; Felix Warburg, New York; Frederic Allen Whiting, Cleveland; Edward Wigglesworth, Boston, and Clark Wissler, New York.

The officers elected by the association by ballots cast prior to the annual meeting were: *President,* Chauncey J. Hamlin, president of the Buffalo Society of Natural Sciences; *Vice-president,* Frederic Allen Whiting, director of the Cleveland Museum of Art; *Secretary,* Laurence Vail Coleman; *Treasurer,* George D. Pratt, trustee of the American Museum of Natural History. These officers tendered their resignations in order that the enlarged council might elect its own officers in accordance with the amended constitution. The president, vice-president and treasurer were reelected. Clark Wissler, curator of anthropology of the American Museum of Natural History, was elected secretary, and Mr. Coleman was appointed executive secretary.

The report of the treasurer showed that receipts during the year for general purposes had totalled approximately $35,500 and that the year had closed with a net income of more than $6,000. This surplus, together with a like amount from the previous year, has been set up as a reserve fund, and it was pointed out that the bulk of this reserve had been derived from items budgeted to the work of the director, but not expended because taken up from a special fund.

The total receipts for special purposes was shown to be in excess of $85,000 and the total for all purposes, therefore, to be more than $120,000.

Pan-American Project

Efforts to bring about closer relations between the museums of North, Central and South America were projected at the meeting—the matter being placed in the hands of the council, which accordingly appointed a committee on Pan-American cooperation. Dr. Clark Wissler is chairman and the other members are Dr. John C. Merriam, president of the Carnegie Institution of Washington, and Dr. Leo S. Rowe, director of the Pan-American Union.

The present project is a development of plans that were begun a year ago. The tentative plan, as summed up in a memorandum which was referred to the committee, is as follows:

(1) To appoint a representative of the association to visit twelve or fifteen museums of the United States during the fall of 1925 for the purpose of explaining the plan to directors and trustees and of finding out exactly what help they are in a position to give to institutions in the South.

(2) To make provision for the representative to visit points in Mexico, Central and South America, to study museum problems, to invite cooperation, to spread an understanding of our attitude and to demonstrate our sincerity through actual service; university centers also to be visited; the report of the trip to include a directory of museums and a program for future cooperation.

It is not anticipated that material results will develop out of a first trip but there is every indication that such a mission would result in the formulation of a far-reaching program which would give a basis for independent activities on the part of American and Latin-American museums in cooperation.

Dr. Wilson's Gift

In his report on museums in national parks, Dr. Bumpus emphasized the importance of creating museums that will minimize indoor exhibits in favor of the out-of-doors ones that nature has already provided, and made a plea for a cessation of collecting activities, even by museums, in places than can be developed as out-of-door exhibits by construction of little shelter museums.

Immediately after this report, Dr. William P. Wilson, director of the Philadelphia Commercial Museum, presented to the association all the anthropological

material which he and Mrs. Wilson had collected in the Southwest in years past. It is his wish that the material be restored to the original settings if that course should prove practicable in the development of museums in the West. This gift was greeted as an important impetus to the movement for branch museums out-of-doors, and was also hailed as the entering wedge which may open up new activities by inducing the creation of official machinery to administer material for distribution to points of greatest need. It was suggested that the problem of mobilizing some of the excess material of large museums for the benefit of small ones might thus be approaching a solution.

At a later session, Dr. Wilson made his gift formally as follows:

> At this, the twentieth annual meeting of The American Association of Museums, as an indication of my faith in the purposes of this organization, of which I was a founder and for twenty years have been an active member, I desire to give to the association all the archeological collections which were obtained by Mrs. Wilson and me, as a result of explorations which were conducted principally by her at Otowi, New Mexico, during the years 1915, 1916 and 1917.
>
> In making this gift I am confident that The American Association of Museums, through its growing interest in science and popular education, will place and care for this material to enhance its value. The gift is only conditioned by the liberal regulations which control the disposition of all similar material secured from public lands under the control of the Department of the Interior.

LAURENCE VAIL COLEMAN,
Executive Secretary

JAY BACKUS WOODWORTH

ON August 4, 1925, after a long illness, Professor Jay Backus Woodworth, of the department of geology and geography at Harvard University, passed away in the sixty-first year of his age. He was connected with the university since the year 1890. After serving as instructor in geology, he was promoted to an assistant professorship in 1901 and to an associate professorship in 1912. Many thousands of students have been introduced to the science of geology by Professor Woodworth. He served the university, not only as an enthusiastic and respected teacher but also as an administrator, serving on many committees and for some years as chairman of the department. Throughout most of his professional career he was a member of the United States Geological Survey and has published many valuable memoirs under the auspices of that survey. Another of his leading contributions to science was a prolonged exploration in the geology of Brazil and other parts of South America. This expedition was financed by the Shaler Memorial Fund, which is controlled by the division of geology at Harvard. It was appropriate that Professor Woodworth could have been the first investigator to be aided by this fund for he was the trusted friend of his master, Professor Nathaniel Shaler, who organized the present department of geology and geography at the university. As a labor of love, Professor Woodworth undertook the rather arduous task of organizing and continuously administering the Harvard Seismographic Station, which has been in continuous operation since the year 1908. Professor Woodworth was one of the American pioneers in the scientific study of earthquakes, and the records from his station have been among those most prized by the seismological stations of the world. This is especially on account of the accurate timing of the records. It is important to note that Professor Woodworth has steadily held the opinion that, according to the testimony of both human history and the geological facts in hand, the city of Boston is not in serious danger from earthquake shocks. Like all other scientific students of New England earthquakes, he recognized that New England is sure to have small shocks at irregular intervals, but he strongly deprecated the effort now being made in certain quarters to lead the public to the opinion that science supports the claim of considerable danger to Boston and New England in general from earthquakes. Professor Woodworth's other chief researches have been in the field of glacial geology, where he was the recognized authority, and in the structural geology of New England, particularly Massachusetts.

Professor Woodworth has served for some years on the National Research Council, his most important contribution to the work of that council being perhaps his service as chairman of the committee on the use of seismographs in war, 1917–18. He was active in the American Association for the Advancement of Science and in the administration of the Geological Society of America, of which he had long been a fellow. He was a member of the American Academy of Arts and Sciences; past president of the Seismological Society of America; a member of the Washington Academy of Science, of the National Geophysical Union, the Meteorological Society of America, Boston Society of Natural History, and other societies.

Professor Woodworth was born at Newfield, New York, the son of the Reverend Allen Beach Woodworth. He is survived by a daughter, Miss Ethel Woodworth.

SCIENTIFIC EVENTS

AN INTERNATIONAL PHARMACEUTICAL CONFERENCE

THE Second International Conference on the Unification of Formulae of Heroic Medicaments will be held in Brussels, Belgium, during the week beginning September 21, 1925.

The first conference of this nature, also held in Brussels, was convened on September 15, 1902, the following countries being represented: Austria, Belgium, Bulgaria, Denmark, France, Germany, Great Britain, Greece, Hungary, India, Italy, Luxemburg, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland and the United States.

The agreements reached were incorporated into a treaty which was signed by the countries represented November 29, 1906. This country signed with the following reservation: "The Government of the United States of America does not assume, by virtue of its signature to this treaty, any other obligation than that of exercising its influence to bring the next edition of the Pharmacopoeia of the United States into harmony with said agreement."

The progress which has been made as a result of the labors of the first conference is most gratifying. The pharmacopoeias which have been revised since the treaty of 1906 became effective show, without exception, that an earnest endeavor has been made to comply with the requirements laid down by the conference. It was to be expected, however, that the agreements reached by this initial conference would require, as further knowledge was gained, revision from time to time, both in the nature of modifications and additions. It is for the purpose of making such changes and additions that the second conference has been called.

The countries that have signified their intention of participating in the second conference are Austria, Belgium, Bulgaria, Denmark, Egypt, France, Finland, Germany, Great Britain, Greece, Haiti, Hungary, Italy, The Netherlands, Norway, Peru, Roumania, Sweden, Switzerland, Turkey and the United States.

Dr. A. G. Dumez, of the Hygienic Laboratory at Washington, is the official delegate to this congress of the Army, Navy and the United States Public Health Service.

THE PROPOSED SANCTUARY FOR WILD ANIMALS IN SOUTH AFRICA

A BILL for the permanent establishment of a great national park and sanctuary for wild animals will come before the Union Government of South Africa. Hopes are entertained that a final obstacle, the presence of some privately owned land within the scheduled area, will be overcome and that the Union, by passing the bill, will create an asset of the highest commercial, popular and scientific value.

The Transvaal, in which the proposed park is situated, has the credit of being the first state in Africa to realize the importance of protecting wild life. In March, 1898, two years before the Conference of African Powers called by the late Lord Salisbury led to the establishment of reserves and sanctuaries in many parts of Africa, the Transvaal government had set apart a district on the Sabi River, between the Drakensberg Mountains and the Lebombo Hills, adjoining Portuguese East Africa, as a sanctuary in which it was forbidden to "hunt, shoot, seek or in any way to intimidate, to chase or to drive, or in any way disturb any game or birds in the game reserve."

The country is known as low veld or bush veld. From east to west it rises in height gradually from about 400 feet above sea level to about 2,000 feet. It is subtropical climatically, and consists of a series of undulating ridges and steep-cut water courses forest clad except below the 1,200-foot level, where it becomes savannah country with rocky outcrops, the home of troops of baboons. There are a few large perennial rivers flowing from west to east and a multitude of tributary water courses, most of them now as a result of the gradual desiccation of South Africa dry except during the rains.

In 1923, under pressure from the companies, the government excised the whole western area of the reserve, amounting to about 1,500,000 acres, between the Olifants River on the north and the Crocodile River on the south.

There remain about seventy farms within the area which are still private property, and it is the acquisition of these at a fair price that is the final obstacle to be overcome. If these are purchased and the remaining area of the original reserve permanently established by the Union Government as a national park and sanctuary, as contemplated by the bill, South Africa will gain possession of one of the greatest reserves in the world.

THE GERMAN CHEMICAL INDUSTRY

AT the ninth annual general meeting of the Association of British Chemical Manufacturers recently held at the Chemical Society's Rooms, Burlington House, Piccadilly, W., D. Milne Watson, the chairman, said, according to a report in the London *Times*, that the chemical industry, though, fortunately, not to such a great degree as some other industries, was going through a serious time. He attributed the mitigation in their case to the organization which they had built up. During the year there had been closer cooperation between the dyestuffs industry and other branches

of the chemical industry. The fine chemical group seemed to have had a fairly quiet year. A very strenuous one awaited them. It was to the public, as represented by the House of Commons, that they must now appeal. The Safeguarding of Industries Act expired next year, and it seemed obvious that the government would require to know what progress had been made in the manufacture of fine chemicals and what effect the act had had. The council was expecting to receive a full report from the group in the autumn and would then review the whole situation.

Dr. E. F. Armstrong said that there was difficulty in finding suitable chemists with a broad outlook to initiate new problems. If the association could bring pressure to bear on the universities so to alter their course of training as to produce the better-class chemists they wanted, it would be much to the benefit of the industry. He thought that they all realized as much as he did the rocks ahead, because of German competition. It would be true to say that the penetration of the German into matters chemical was even wider, more rapid, and more serious to-day that it was in 1914. The fight was going to be an arduous one.

Mr. N. H. Graesser said that he had recently returned from Germany. He had been amazed to see what developments had occurred in the last year or two. Apparently there was now no home competition there at all. Everything was coordinated. They had their fine chemical convention, and that consisted of firms working to a common policy. But in the dye industry itself he understood that there was only one group. They had bought up all the smaller firms who used to be independent, or had obtained control over them, and they were working as a national industry, with no competition in their own country and with a national effort for all outside business. He was told that in this process of coordination they had recently made tremendous further steps. One of the directors of a large concern told him that since January they had stopped 4,000 men, simply in the transfer of processes to larger scale and power plants. Every plant that was not absolutely up-to-date was simply left, and on any plant that could be revised they were spending money freely. The one feature that seemed to be causing them any trouble was liquid capital and the competitive nature of the market. The reports on labor were uniformly good.

FEDERAL FUNDS FOR SCIENTIFIC RESEARCH IN AGRICULTURE

ACCORDING to information received from the Missouri College of Agriculture, one of the most important and far-reaching laws in the interests of agriculture prepared by the dean of the college, Dr. F. B. Mumford, was approved by President Coolidge on February 24, 1925. This law provides for increased appropriations to the colleges of agriculture of the several states for scientific research in the interest of agriculture. The bill provides for an initial appropriation of $20,000 for the first year and $10,000 additional each year thereafter until the total appropriation shall have reached $50,000 annually. The provisions of the bill limiting the use of these funds are indicated by the following quotation from the bill:

> The funds appropriated pursuant to this act shall be applied only to paying the necessary expenses of conducting investigations or making experiments bearing indirectly on the production, manufacture, preparation, use, distribution and marketing of agricultural products and including such scientific researches as have for their purpose the establishment and maintenance of a permanent agricultural industry; and such economic and sociological investigations as have for their purpose the development and improvement of the rural home and rural life; and for printing and disseminating the results of such researches.

The administrative features of this bill are similar to those of the Hatch and Adams Acts providing funds for agricultural experiment stations, but the uses for which these funds may be expended are broader and place emphasis upon certain phases of agricultural research in agricultural economics, home economics and rural sociology. This increased emphasis upon the business side of farming is a recognition of the importance of world economic conditions in the development of agriculture. The prosperity of the farmer is not alone dependent upon efficient production methods, but is determined by economical methods of distribution and marketing. Investigations in distribution and marketing of farm products will therefore be undertaken by all the stations benefiting from this act. The bill also recognizes that the solution of the rural problem involves rural conditions. It therefore provides for investigations of the rural home and rural living.

This endowment for agricultural research, added to amounts already available, will represent a major endowment of approximately $250,000,000 and an annual income of more than $10,000,000 for the state experiment stations.

RAMSAY MEMORIAL FELLOWSHIPS

THE Ramsay Memorial Fellowship trustees have made the following awards of new fellowships for the session 1925–26:

A British fellowship of £300, tenable for two years, to Mr. G. A. Elliott, B.Sc., for work at University College, London.

A British fellowship of £300, tenable for one year, to Mr. H. R. Ing, M.A., D.Phil., for work in the University of Manchester.

A Glasgow fellowship of £300, tenable for two years, to Mr. T. C. Mitchell, B.Sc., for work in the University of Cambridge.

A Glasgow fellowship of £300, tenable for one year, to Mr. J. D. Fulton, M.A., B.Sc., for work in the University of Manchester.

A Canadian fellowship to Mr. D. McKay Morrison, M.Sc., Ph.D., for work in the University of Cambridge.

A Japanese fellowship of the value of £370, to Dr. Seisi Takagi, for work at University College, London.

The trustees have renewed the following fellowships for the same session:

Mr. S. W. Saunders, B.Sc., Ph.D. (British fellowship), for work at University College, London; Mr. Kai J. Pedersen (Danish fellowship), for work in the University of Bristol; M. M. Mathieu (French fellowship), for work in the Davy Faraday Laboratory, Royal Institution, London, and Dr. Nicolas Oeconomopoulos (Greek fellowship), for work at University College, London.

Sir Robert Waley-Cohen has been appointed a trustee of the Ramsay Memorial Fellowship Trust, in place of the late Sir George Beilby.

SCIENTIFIC NOTES AND NEWS

PROFESSOR NEILS BOHR, of Copenhagen, has received the Barnard gold medal for meritorious service to science from Dr. John D. Prince, American minister to Denmark, acting on behalf of Columbia University, where he was once a professor. The medal was awarded to Professor Bohr in recognition of his researches in the structure of atoms by the trustees of Columbia University in April, on the nomination of the National Academy of Sciences.

A MEDAL for archeological research has been instituted and attached to the Board of Archeology in the University of London. The first presentation was made at University College on July 7 to Sir Flinders Petrie in recognition of his half-century of work for archeology.

THE honorary degree of LL.D. has been conferred by the University of Aberdeen on Dr. J. J. R. MacLeod, professor of physiology at the University of Toronto.

THE degree of doctor of laws has been conferred by Wabash College on Dr. J. N. Rose, research associate in botany of the Carnegie Institution. Dr. Rose graduated from the college in 1885 and received the Ph.D. in 1889.

ARTHUR LOWENSTEIN, chemist and vice-president of Wilson and Company, has received the honorary degree of doctor of science from the University of Cincinnati.

THE Walker prize of $100, awarded annually by the Boston Society of Natural History for the best essay in the field of natural history, has been given this year to Edward F. Holden, of the University of Michigan, for his manuscript entitled "The pigment of amethyst."

THE Comet Medal of the Astronomical Society of the Pacific has been awarded to Professor Max Wolf, of Heidelberg, Germany, for the discovery of an unexpected comet on December 22, 1924.

THE Spanish Achúcarro prize for distinguished work in the histology of the nervous system has been awarded to Professor K. Schaffer, chief of the Budapest Institute for Research on the Brain. This prize is awarded every two years alternately to a Spanish and a foreign histologist.

DR. RAPHAEL ISAACS, instructor in medicine at the Harvard Medical School, has won the Alvarenga prize of the College of Physicians of Philadelphia, which is given annually for the best essay on a medical subject. Dr. Isaacs' subject was "The nature of the action of Roentgen rays on living tissue."

DR. TRUMAN W. BROPHY, of Chicago, was awarded the Miller prize for dental research at the opening session of the annual meeting of the International Dental Federation in Geneva. He also was made an honorary member of the Swiss Odontological Society.

DR. CHEVALIER JACKSON, of Philadelphia, has been honored by the French government with membership in the Legion of Honor. Dr. Jackson is now in France lecturing at the University of Paris on bronchoscopic work.

AT the recent meeting of the International Research Council in Brussels, the reelection of M. E. Picard as president was proposed by Professor Lorentz and was unanimously agreed to. Dr. George E. Hale and M. Lecointe being unable for reasons of health to serve on the executive committee, Dr. Vernon Kellogg and M. P. Pelseneer were elected to fill these vacancies.

AT the annual meeting of the American Society for Clinical Investigation, held in Washington, Dr. Charles C. Bass, dean of the School of Medicine at Tulane University, was elected president.

SIR ST. CLAIR THOMSON, M.D., has been reelected president of the Royal Society of Medicine.

HUGH D. MISER, of the United States Geological Survey, has been appointed state geologist of Tennessee, to succeed Wilbur A. Nelson, who goes to Virginia to become state geologist and head of the department of geology in the University of Virginia.

WITH the last issue of *The Nation's Health*, Dr. C.-E. A. Winslow, professor of public health, Yale School of Medicine, New Haven, Conn., retires as editor and is succeeded by Dr. Frank L. Rector, former secretary of the Conference Board of Physicians in Industry and medical investigator for the National Industrial Conference Board, New York.

PRINCIPAL JOHN YULE MACKAY has resigned the chair of anatomy in University College, Dundee. He will continue to hold office as principal of the college.

PROFESSOR R. W. REID, who had held the chair of anatomy at the University of Aberdeen, Scotland, since 1899, has resigned.

A. C. STEPHEN, junior naturalist on the scientific staff of the Fishery Board of Scotland, has been appointed assistant in the Natural History Department of the Royal Scottish Museum, Edinburgh, in succession to Dr. E. L. Gill, recently appointed director of the South African Museum, Cape Town.

DR. M. J. VAN WAGENEN, of the department of educational psychology at the University of Minnesota, has been granted a year's leave of absence to accept an appointment as visiting lecturer in educational psychology and statistics at the University of California for the year 1925–26.

DR. WILLIAM A. PERLZWEIG, chemist to the medical clinic in the Johns Hopkins University and Hospital, sailed on a six-months' leave of absence for the purpose of study in the chemical laboratories of Professor F. Pregl in Graz and of Professor S. P. L. Sørensen in Copenhagen.

RAYMOND DITMARS, curator of reptiles of the New York Zoological Society, will sail for Rio de Janeiro on August 15, where he is going to study and collect poisonous snakes.

LIEUTENANT G. C. JONES, director of the U. S. Coast and Geodetic Survey, is now at work in the Aleutian Islands, making a reconnaissance of certain islands, which includes magnetic observations at well-determined positions.

THE memory of John Ericsson, the distinguished engineer, was honored on August 7 at the annual dinner of the John Ericsson Society at the Engineers Club. Among the speakers were Lieutenant Commander John H. Barnard, C.S.N.; C. C. Hulth, of the General Electric Company; J. Skogmark, one of the inventors of smokeless powder, and Charles K. Johansen, editor of the *Swedish North Star*. Mr. Johansen announced that a statue of Ericsson would be erected on May 1 next year in Lincoln Park, Washington, D. C. A radiogram of congratulations was read from the Mayor of Filipstad, Sweden, Ericsson's birthplace.

The Geographical Journal reports that friends and admirers of David Carnegie, the explorer of Western Australia, who was killed while on service as resident in Nigeria in 1900, are raising a memorial to him in Brechin Cathedral and in Perth, W. A. A bas-relief portrait has been executed by Mr. William Lamb, of Montrose, and is to be cast in bronze for the two memorials. His death was caused by a poisoned arrow in an ambush where he was operating against a marauding chief.

PHILADELPHIA has been chosen as the place of meeting of the American Chemical Society for its semicentennial celebration during the week of September 6, 1926.

THE American Institute of Electrical Engineers will meet in Seattle from September 15 to 18, under the presidency of Dr. M. I. Pupin, professor of electromechanics at Columbia University and president of the American Association for the Advancement of Science.

THE thirty-fourth meeting of the American Astronomical Society will be held at Goodsell Observatory of Carleton College, Northfield, Minnesota, from September 8 to 11. Northfield is about thirty-five miles south of St. Paul, Minnesota, and may be reached by way of the Chicago, Milwaukee and St. Paul, and the Chicago, Rock Island and Pacific railroads. Members are reminded that advantage can be taken of reduced summer fares. In particular, such an excursion as to the Yellowstone National Park can be combined to advantage with the trip to the meeting. Members of the society and visitors will be given rooms and board in one of the college dormitories, in which there are suitable accommodations for both men and women. It is expected that the cost will not exceed $3.50 per day for room and meals.

THE first scientific Congress of Geophysicists, representing the geophysical institutions of the Soviet Union, was held at Moscow from May 17 to 24, five hundred and eleven members being present. One of the principal questions before the Congress was the coordination of the Geophysical Service throughout the Union of the Socialist Soviet Republics, and the connection between the Geophysical Services established in the separate Sovietic republics and regions was defined. The scientific work of the conference was divided into five sections, as follows: meteorology and aerology; actinometry, electrometeorology, atmospheric optics and acoustics; climatology; dynamic and synoptic meteorology, and terrestrial magnetism, and seismology and graviometry. A special commission for the study of the drought and its peculiarities was organized. Seventy-five reports relating to questions

of organization and 260 scientific reports were presented to the congress.

WE learn from *Nature* that the third International Congress of Entomology opened its meetings at Zurich on July 20, after a reception of the delegates on the evening of July 19. The first of these congresses was held at Brussels, and the second at Oxford. In August, 1914, the third was to have met at Vienna, but circumstances made this impossible. Science, however, is international, and "Time the Healer" suggested the resumption of these meetings, and Zurich was chosen as neutral ground. About 200 members are in attendance, 60 of them from Britain. Nearly all the European countries are represented—though there are significant exceptions—as also India, Canada, South Africa and the West Indies. The United States is represented by Dr. L. O. Howard and others, while there are representatives from Egypt and Mexico. Switzerland is naturally well represented, and the president is Dr. A. von Schulthess. A very full program has been arranged under the sections morphology, systematic entomology, biology and development, bionomics and nomenclature.

AT the British Empire Exhibition, Wembley, an "international conference of women in science, industry and commerce" was recently held, under the auspices of the Women's Engineering Society and kindred bodies, including the Electrical Association for Women. The conference was opened by the president, H. R. H. the Duchess of York, with Lady Astor, M.P., in the chair, and after luncheon there was to be a tour of the exhibition. The speakers and delegates were entertained to luncheon at the Wembley Garden Club by the president and council of the British Electrical Development Association (Inc.), and amongst those present were Miss Margaret Bondfield and Miss V. Holmes. On the following morning the session was to be devoted to "Engineering, chemistry and research," Miss C. Griff, presiding, and one of the papers was entitled "Electricity applied to mining," by Miss H. M. Davis; the subject for the afternoon was "Industrial welfare and factory inspection," with Mrs. Willson in the chair, and a reception was arranged for the evening. On the next day Mrs. Hoster presided at the morning session on "Commerce and salesmanship," papers being read by Miss G. Burlton on "Salesmanship" and by Miss L. F. Nettlefold on "The place of the wholesaler in the scheme of distribution"; and in the afternoon, with Alderman Mrs. Hammer in the chair, the subject was "Electricity—domestic science," papers being read on "Producing and distributing electricity," by Miss M. Partridge and "At home with electricity," by Miss T. J. Dillon, and accompanied by a special demonstration of electrical apparatus.

THE fourth annual meeting of the National Conference on Pharmaceutical Research will be held at Fort Des Moines Hotel, Des Moines, Iowa, on Saturday, August 22, 1925, of which H. V. Arny, of New York, is chairman. There will be two sessions: one beginning at 10 A. M. and the other at 2 P. M. The tentative program is as follows: Reports of officers, reports of the 10 standing committees, reports from delegates from the following affiliated organizations: (a) Association of Official Agricultural Chemists. (b) American Chemical Society, Division of Chemistry of Medicinal Products. (c) American Conference of Pharmaceutical Faculties. (d) American Drug Manufacturers' Association. (e) American Pharmaceutical Association. (f) American Pharmaceutical Manufacturers. (g) Bureau of Chemistry, U. S. Department of Agriculture. (h) Joint Committee on Definitions and Standards of Food and Drugs. (i) National Association of Boards of Pharmacy. (j) National Association of Retail Druggists. (k) National Formulary Revision Committee. (l) Pharmaceutical Laboratory Seminar. (m) Plant Science Seminar. (n) Proprietary Association. (o) U. S. P. Revision Committee. There will be general discussions on: (a) Census of research, (b) graduate students in pharmacy and their research work, and (c) research topics.

THE Royal research ship *Discovery* sailed on July 23 from Portsmouth for the Falkland Islands *via* the West Coast of Africa and Cape Town. The object of the expedition is to undertake research into the habits of whales, and make other scientific investigations in the region of the Dependencies of the Falkland Islands and elsewhere. Officers of the ship include the following: Director of research, Dr. Stanley Kemp; chief zoologist, Mr. A. C. Hardy; assistant zoologists, Mr. J. R. Hamilton and Mr. E. R. Guntner; hydrologist, Mr. H. F. P. Herdman; medical officer, Lieut-Col. Marshall; captain, Commander J. R. Stenhouse; navigating officer, Lieutenant-Commander J. M. Chaplin.

IT was recently stated in SCIENCE that the General Electric Company had presented apparatus to Sir William Bragg. The facts are that the General Electric Company has joined with the British Thomson-Houston Company, Ltd., of England, in presenting an X-ray diffraction apparatus to Professor W. L. Bragg, of the University of Manchester, England. The two companies are also joining in a gift of a high voltage direct current outfit to Sir Ernest Rutherford, of the Cavendish Laboratory, University of Cambridge, England.

A BEQUEST to be known as the Charles Patrick Daly and Marie Lydig Daly Fund, the annual income from which will be about $1,000, has become available to the New York Botanical Garden.

A NEW experimental and research station at Cheshunt, Herts, England, has been opened by Lord Bledisloe, Parliamentary secretary to the Ministry of Agriculture. The new building contains an entomological laboratory and a laboratory for the treatment of plant soils. There is also a fireproof room on the roof for the storage of experimental records and a demonstration room where discoveries made at the station may be demonstrated to a large number of growers. The building has been erected at a cost of £4,800, of which £2,800 has been contributed by the ministry of agriculture. The remainder has been guaranteed by horticultural growers.

ALL branches of the German electrical industry will be represented by exhibits at the Technical Fair to be held at Leipzig, Germany, from August 30 to September 9. The German manufacturers at this time will display their latest developments in all types of equipment, including motors and generators, transformers, insulating material, electric railway equipment, measuring instruments, small farm plants and industrial machinery.

A NATIONAL exposition on health, social welfare and physical training is to take place in Dusseldorf, in 1926, under the auspices of the National Government and with the cooperation of the state governments and various private organizations. The purpose of the exposition is to point out to the German people the importance of proper care of the health, to enable them to meet their obligations in Germany and outside of it. More than 1,000 specialists in various fields are engaged in arranging for the exposition.

ACCORDING to a cable to the New York *Times*, the Oxford University Press has issued the first volume of a "World List of Scientific Periodicals." It has been found that more than 24,000 periodicals publishing results of scientific research existed in the world between 1900 and 1921. Each periodical was subjected to a severe test before including it in the list, and it was found that the entire 24,000 periodicals listed publish regularly or occasionally contributions to scientific knowledge which ought not to be overlooked. A second volume of the report soon to appear will tell at what libraries the different scientific periodicals are obtainable. The investigation was conducted by a British joint board of scientific societies, aided by a grant from the trustees of the Carnegie United Kingdom Trust.

A SURVEY of air transportation is to be undertaken jointly by the Department of Commerce and the American Engineering Council.

UNIVERSITY AND EDUCATIONAL NOTES

PLANS to erect a medical center at the University of Pittsburgh, at a cost of $14,000,000, have been announced recently by the university's medical committee. Agreements have been perfected to include the Presbyterian, Children's, Elizabeth Steele Magee, Montefiore and the Eye and Ear Hospitals in a group to be operated in conjunction with the university's fifty-two story cathedral of learning.

THE corner-stone of the $1,500,000 physics building of Columbia University was laid on August 7. It will be a twelve-story structure and will be ready for occupancy in September, 1926.

THE new hospital at the University of Michigan, which has been under construction for the last five years at a cost of $3,500,000, was opened on August 10.

IN accordance with recent legislation, the University of Kansas, the Kansas State Agricultural College and the three state teachers' colleges on July 1 passed under the control of a non-salaried board of regents of nine members, appointed by the governor. The first board comprises three members for one-year terms, two for two years, two for three years and two for four years, and their successors will regularly be appointed for four-year terms.

HAROLD S. BOARDMAN, dean of the college of technology, has been made acting president of the University of Maine, to take the place of Dr. Clarence C. Little, who recently resigned to accept the presidency of the University of Michigan.

DR. CASWELL A. MAYO, formerly dean of the Queen City College of Pharmacy, Cincinnati, has been appointed dean of the New Jersey College of Pharmacy.

JOHN YOUNGER, consulting engineer, has been appointed head of the department of industrial engineering at the Ohio State University.

AT the University of Colorado, Dr. Ralph Garfield Mills, of the Northwestern University Medical School, has been appointed professor of pathology and head of the department of pathology, and Dr. Ivan Hall, of the University of California, professor and head of the department of bacteriology.

AT the University of Idaho, Dr. Irving H. Blake, associate professor of biology at the University of Maine, has been elected to the associate professorship of zoology, taking the place of Professor R. A. Muttkowski, who is now head of the department of biology at Detroit University. Dr. Howard B. Stough, Ph.D. (Harvard), will fill the new position of assistant professor of zoology.

DAVID B. CHISHOLM, teaching fellow in geology and mineralogy at Syracuse University for the past two years, has been appointed instructor in geology and mineralogy at Colgate University.

Dr. FLOYD DE EDS has been appointed assistant professor of pharmacology at the Stanford University Medical School.

DUGALD C. JACKSON, JR., assistant professor of electrical engineering at Duke University, has been placed in charge of the department of mechanical and electrical engineering at the new Speed Scientific School of the University of Louisiana.

PROFESSOR T. TURNER has been elected dean of the faculty of science at the University of Birmingham, in succession to Professor F. W. Burstall.

E. A. SEAGAR has been appointed to the post of lecturer in tropical sanitation and hygiene, established by the International Health Board, in the Imperial College of Tropical Agriculture, Trinidad.

DISCUSSION AND CORRESPONDENCE

THE NOMENCLATURE OF THE VITAMINES[1]

THE results of modern vitamine research seem to render certain important changes in the nomenclature imperative, and in this connection the following designations are suggested.

First of all, it seems advisable at this stage to separate the active substances, known under the name of vitamines, into two groups, one group which contains nitrogen and is unstable to the action of alkalies to be designated as vitamines, with the original spelling retained, and another group, which does not contain nitrogen and is stable to the action of alkalies, to be designated as vitasterols.

These new designations would keep before our eyes the fact that these two groups have been developed by the same thought and by the same methods of investigation and at the same time state that we deal here with two entirely different chemical groups. The work of Steenbock, Sell and Buell,[2] Takahashi[3] and Dubin and Funk[4] on cod liver oil suggests very strongly that the active substances which interest us here are entirely free from nitrogen and belong to the group of sterols, without, however, being identical with the ordinary cholesterol. It is being agreed on now that the substance curative of xerophthalmia and that one of rickets are not identical and should be called by a different name. The facts recently brought out by Steenbock[5] and Hess[6] and their collaborators that a number of oils can acquire antirachitic potency by exposing them to the ultra-violet rays, can not be construed against the existence of a specific antirachitic substance in cod liver oil, egg yolk a. s. f. The fact that even chemically pure cholesterol can be activated in the above described manner fortifies us in the assumption that these substances belong to the group of sterols. Hess, Weinstock and Helman[7] found recently the activation of cholesterol. Cholesterol thus radiated apparently failed to show any chemical changes except a better penetration of the shorter ultra-violet rays. We have been also working on the subject, before this publication appeared, and so far were unable to detect any chemical changes produced by the rays. It is, however, likely that chemical change is being produced by these means.

The recent work on reproduction and possibly lactation by Evans and Bishop,[8] Mattill and Carman[9] and Sure[10] suggests the existence of a new vitasterol, which we will designate with the letter F. This substance is also being found in the lipoid soluble fraction and possibly can be genetically connected with the hormone of the sexual gland, belonging, as it seems, also to the sterol group.

If we return now back to the vitamine group, we have here substances like vitamine B, vitamine D (promoting the growth of yeast), which according to the work of Funk and Dubin,[11] Lash Miller[12] and Eddy, Kerr and Williams[13] are composed probably yet of complexes. The vitamine C remains in this class, and we may expect here a new representative, namely, vitamine P, the antipellagra principle. The existence of the latter is strongly suggested by the work of Goldberger and Tanner,[14] in confirmation of the early hypothesis of the author regarding the cause of pellagra. Goldberger and Tanner have found this principle in yeast and have proved in the same time that the accepted thesis of the curative power of animal proteins, like casein, is due to an impurity, as was already suggested by the experimental work of

[1] From the Department of Chemical Hygiene, State School of Hygiene, Warsaw, Poland.

[2] Steenbock, Sell and Buell, *J. Biol. Chem.*, 47, 89, 1921.

[3] Takahashi, Proc. Jap. Chem. Soc. *J. Chem. Soc. Jap.*, 43, 828, 1922.

[4] Dubin and Funk, Proc. Soc. Exp. Biol. Med., 21, 139, 458, 1923–24. *J. Metab. Res.*, 4, 461, 467, 1923.

[5] Steenbock, SCIENCE, 60, 224, 1924; Steenbock, Black and Nelson. *J. Biol. Chem.*, 61, 405, 1924, 62, 209, 1924.

[6] Hess and Weinstock, *J. A. M. A.*, 83, 1845, 1924. Proc. Soc. Exp. Biol. Med., 22, 5, 1924. Hess, Weinstock and Helman, *ibid.*, 22, 76, 1924. Hess and Weinstock. *J. Biol. Chem.*, 62, 301, 1924.

[7] Hess, Weinstock and Helman, Proc. Soc. Exp. Biol. Med., 22, 227, 1925.

[8] Evans and Bishop, SCIENCE, 56, 650, 1922.

[9] Mattill and Carman, *J. Biol. Chem.*, 61, 729, 1924.

[10] Sure, *ibid.*, 62, 371, 1924.

[11] Funk and Dubin, Proc. Soc. Exp. Biol. Med., 19, 15, 1921.

[12] Lash Miller, SCIENCE, 59, 197, 1924.

[13] Eddy, Kerr and Williams, *J. Amer. Chem. Soc.*, 46, 2846, 1924.

[14] Goldberger and Tanner, U. S. Publ. Health Rep., 40, 54, 1925.

Freedman and Funk.[15] Whether we deal here with a new vitamine or with one of the already known ones, only the future study will decide. Summarizing the above the following classification is suggested:

VITAMINES	VITASTEROLS
Vitamine B, or the anti-beriberi vitamine.	Vitasterol A, or the anti-xerophthalmic vitasterol.
Vitamine C, or the anti-scorbutic vitamine.	Vitasterol E, or the anti-rachitic vitasterol.
Vitamine D, or the yeast-growth promoting vitamine.	Vitasterol F (?), or the reproduction vitasterol.
Vitamine P (?), or the antipellagra vitamine.	

It would seem that the general adoption of this provisional and unified classification would correct the chaos existing now in the literature and would in the same time meet many of the present justified criticisms. This proposed nomenclature will be suggested at the meeting of the International Union of Chemistry this year at Bucharest.

CASIMIR FUNK
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THE POLITENESS OF AMERICAN BOTANISTS

DRS. ROSE and Stevens have found that American botanists are suffering from what they believe to be excessive politeness, and propose as a remedy the establishment of a new journal or two.[1]

The writer does not care to raise the issue as to whether American botanists are excessively polite or even moderately so; but granting the condition, the proposed cure could serve only to aggravate the situation. If botanical literature is suffering from a lack of criticism, the only possible means to correct this condition is to develop critics, not journals. However, in those branches of botanical science familiar to the writer there seems to be no tendency to follow the apparent practice of the phytopathologist, of indulging in critical remarks only "when neither the author of the paper nor the editor of the journal is present."

Although the established journals may not actively solicit criticisms, they seem willing enough to accept them for publication when offered. The truth of the matter is that the number of published articles has reached such a quantity that critical perusal is possible only for a few. Most botanists capable of offering constructive criticism are engaged in original investigations and can pause only long enough to criticize the articles in their restricted field.

If general criticism is desired it must be undertaken in the botanical sciences, as in literature, by novices just breaking in or by professionals who lack the ability to produce. Such criticism doubtless will prove to be even more worthless in botany than in literature, but if the authors feel that this sort of thing really is valuable they need not await the establishment of a medium of publication—the field is clear.

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IN the preparation of their article on "The excessive politeness of American botanists" in SCIENCE of June 26, Rose and Stevens were doubtless activated by the motive of raising the standard of American botanical publications. While there can be no argument as to the worthiness of this motive, yet there may be some question as to the most effective *modus operandi*. Their view is that the best method is free criticism in print.

Obviously discussions on the floor of scientific meetings have great value in forcing the author to defend his thesis, and in suggesting new viewpoints and lines of attack; however, published criticisms unaccompanied by additional data may prove a deterrent to progress, if not, indeed, an actual menace to the advance of science. If papers which purport to be scientific are obviously worthless or superfluous, or display gross ignorance of previous work, they can scarcely be corrected by cluttering up the literature with public reprimands intended to demolish them. The way to correct or eliminate them is by a rigid editorial censorship. The responsibility for the two papers cited as disgraceful must be attributed as much to the oversight of the editors as to the ignorance of the authors.

On the other hand, there is a type of published scientific criticism which is far more worthy of encouragement than are mere expressions of contempt or accusations of misstatement. If a paper contains data which is open to question or misinterpretations, the errors can be corrected, not by a mere statement of doubt, but only by a repetition of the experiment, observation or analysis, perhaps with more refined methods. In fact almost all scientific progress consists in a criticism of previous work in the light of new discoveries. Such criticism is constructive and worthwhile. Modern scientific literature abounds in it, whether it be American, European or Asiatic. The most conspicuous recent example that has come

[15] Freedman and Funk, *J. Metab. Res.*, 1, 457, 469, 1922.

[1] Rose, D. H., and Stevens, Neil M., "The excessive politeness of American botanists," SCIENCE, N. S., Vol. lxi, No. 1591, pp. 656–657, June 26, 1925.

to my attention is the paper by Bessie Goldstein in the Torrey *Bulletin,* in which she shows that the reports of the occurrence of binucleated cells by Hutchinson and by Beer and Arber were due to the observation of cells with cell-plates in polar view.

A limited number of high-class criticisms written for the sole purpose of criticizing are undoubtedly beneficial. This applies especially to books and papers accepted for publication by non-scientific editors. But I for one do not feel the need of further burdening our already over-taxed publication facilities with fault and flaw finding Philippics which add nothing to the sum total of human knowledge. *Botanical Abstracts* supplies us with satisfactory reviews of all papers. Is it not well that *ex cathedra* critical effusions are giving place to the reinvestigation of critical problems?

CLIFFORD H. FARR

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EVOLUTION AND THE BIBLE

UNDER the above caption, Dr. Ira D. Cardiff, in SCIENCE of July 31, very properly points out that many of those who are coming forward to the defense of evolution are not scientists of any standing. Probably some of those defending the Biblical account of creation are not scholars of any standing. Debates will undoubtedly frequently be held by people of little or no training in either of the fields that they are discussing. Votes taken by audiences listening to such debates are nothing more than expressions of opinion on the efficiency of the individual debaters, but that is true of debates on practically all subjects, and there is in it no serious danger either for science or religion.

It is quite as foolish for a specialist in religion to attempt to criticize and to analyze scientific subjects with which he is not familiar as it is for a scientist to attempt to criticize and analyze religion or the Bible unless he is thoroughly familiar with the subject.

Many scientific men of good standing in their specialties are quite ignorant of closely related scientific fields, and grossly ignorant of the history and philosophy of religion. There are many others, however, who while they have become great specialists have also given as careful study to other unrelated fields. I happen to know quite a number of the scientists of high station referred to by Cardiff as having done harm to science by their statement that there is no conflict between science and religion, meaning presumably the Christian religion in its broadest sense. I think it may be fairly said that their statement represents the conviction of a very large number if not the majority of scientific men with whom in the past thirty years I have had occasion to discuss this subject. There can be no conflict between truths in the two fields. No scientist will refuse to recognize truth wherever he finds it. I am glad the "scientists of high station" had the "moral courage" to make the statement they did.

Mr. Cardiff is doing the real harm to science by taking an unscientific attitude toward religion.

ALBERT F. WOODS

UNIVERSITY OF MARYLAND

I can not help thinking that Dr. Ira D. Cardiff, in his letter (SCIENCE, July 31, p. 111) on "Evolution and the Bible," is really quite off on the wrong track.

The first chapter of Genesis is not in the least "primitive Jewish folk lore"—though most of the second chapter pretty certainly is. But that "Elohist" first chapter, in its present form, is probably nearly as late as Aristotle's day, and, on the whole, fair Mediterranean science of its time. The weakness of the fundamentalist argument is that it reads into this by no means absurd account of creation various ideas that are not there at all. The way, then, to meet his demand that we shall "take the Bible literally" is to take him at his word and do precisely that. Do this—with a good dictionary—and it immediately appears, that although, naturally, Genesis I does not support "Darwinism," neither does it any more support the "Linnaeanism" which the anti-evolutionists read into it.

I do not happen to know how skillfully this Mr. Cantrell may have handled his case before an audience; but I do think he is pursuing a sound strategy. After all, the Bible does not support fundamentalism. Therefore, the way to beat the fundamentalist is to get him to read the Bible—which he rarely does, being too busy hunting up proof-texts.

E. T. BREWSTER

ANDOVER, MASS.

SCIENTIFIC BOOKS

History of the Beet (Beta) as a cultural Plant (Geschichte der Rübe (Beta) als Kulturpflanze) from the oldest times until the publication of Achard's principal work (1809). An anniversary essay, in honor of the 75th year of the foundation of the "Verein der Deutschen Zuckerindustrie." By PROFESSOR DR. EDMUND O. VON LIPPMANN, Hon. Dr. Eng., Technical High School of Dresden and Director of the Halle Sugar Refinery in Halle, Germany. One illustration, 184 pages, 16 × 23½ cm. price bound 12 gold marks. Julius Springer, Berlin, 1925.

THE present volume is the third quarti-centennial essay which has been issued by the "German Indus-

trial Sugar Association" since its establishment in 1850. The first publication of this nature upon the "Origins of Beet Sugar Manufacture" was written by C. Scheibler in 1875; the second upon the "Development of the Beet Sugar Industry from 1850 to 1900 was written in 1900 by the author of the present memorial upon the "History of the Beet as a Cultural Plant." Professor Lippmann mentions in his preface that this new work is the ultimate result of an effort to bring the fragmentary sketch of the sugar beet, which he had prepared in 1890 for his well-known "History of Sugar," to a greater state of accuracy and completion.

As in his previous scientific, technical and historical writings, Professor Lippmann has condensed into this new treatise a vast amount of learning and research. He informs us that the earliest known reference to the beet is contained in an old Babylonian catalog of the plants that were cultivated in the gardens of King Merodachbaladan, who reigned from 722 to 711 B. C., in which record it appears under the name Silqa. This word, as well as the Syrian selka, and the Greek σικελός employed by Theophrastos, indicate Sicily as probably the place where the wild Beta maritima, which grows on the shores of the Mediterranean, was first cultivated. From the time of its early domestication in Sicily before 1000 B. C. the author traces the history of the beet first in ancient Greece, Italy and the other Mediterranean nations and then down through the successive centuries of the middle ages until 1809, when Achard published the results of his classical experiments (1786–1809) which placed the manufacture of beet sugar upon its earliest successful basis.

The perplexing question of the botanical origin of the beet is critically discussed in a special chapter. Owing to the fact that early writers frequently gave the name of beet to other root crops, such as turnips, radishes, parsnips, carrots, etc., the greatest confusion of nomenclature has prevailed and much caution must be exercised in interpreting the ancient records.

This new volume is another evidence of the many-sided ability of Professor Lippmann as chemist, technologist and author. It is a most interesting repository of botanical, agricultural and historical information. Curious bits of folk-lore, literary citations and entertaining episodes are interwoven with descriptions of the uses of the beet as a vegetable, a cattle food, a medicine and a crop for the manufacture of sugar. The copious footnote references to original sources of information as well as the excellent indices of authors, names and subject-matter make the book invaluable to those who wish to delve deeper into the subject.

The book is splendidly printed in clear Roman type and is very free from typographical errors, only one slight misprint (parenips for parsnips on p. 98) coming to the reviewer's attention. The single illustration in the volume is of particular historic interest, as it reproduces a drawing of the root, leaves and stalk of the beet contained in the Vienna manuscript of the "Materia Medica" of Dioscorides written about 500 A. D.

Professor Lippmann's new treatise is one which will appeal to all botanists, agriculturists and ecologists. It is also heartily recommended to every student of the history of science.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

MOUNTING AND EXHIBITING RELIEF MODELS

THE writer has recently completed a large relief model of the Bloomington, Indiana, Quadrangle. The model is mounted on a tripod of suitable height. The legs of the tripod are equipped with glides so that the model can be moved easily to any desired position on the floor. To the top of the tripod a large strap hinge is bolted and the model is securely bolted to the movable part of the hinge.

The model is so nearly balanced on the hinge that it can easily be tilted and securely fastened at any angle by means of a chain and hook on the back of the model frame. When not in use the model rests in a nearly vertical position, being supported by the hinge and resting against the legs of the tripod to which it can be fastened by hooks for additional security.

This method of mounting models that are too large to be easily moved by hand is especially convenient for class-room instruction since it makes an easily manageable model that can be viewed from any angle by members of the class. This free movement of the model would not be possible if it were fastened to a wall or immovably fixed on a frame.

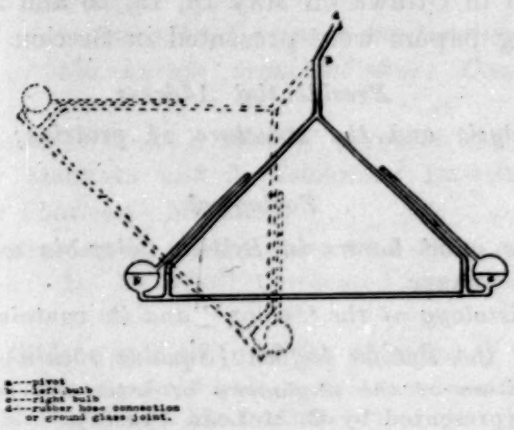
The writer believes this method of mounting may be of interest to others who have occasion to mount or use illustrative material of this sort.

ARCH R. ADDINGTON
INDIANA UNIVERSITY

A DUPLEX VACUUM GAUGE

IT is evident from the sketch that readings are made by tipping the gauge through an angle of 45 degrees either side of the center line.

Connection to the system has been found satisfactory in most cases with high-grade vacuum tubing, but connection may also be made with a ground glass joint sealed with mercury.



The advantages of the gauge are that a minimum of mercury is required, less space is taken and perhaps most important there is no exposed surface of mercury.

RALPH C. HARTSOUGH

COLUMBIA UNIVERSITY

SPECIAL ARTICLES

A ROT OF THE SMYRNA FIG IN CALIFORNIA

THE fig was introduced into California with a fair promise of being free from diseases which are so common on other fruits. The promise has faithfully been kept as far as the foliage is concerned, but the fruit is suffering from a number of diseases, the first of which has been early described by N. B. Pierce[1] as "a destructive fermentation of the fruit caused by a yeast," but no further work was done on the trouble.

While the writer, in the fall of 1922, was engaged in preliminary field survey for a study of this fermentation of figs, his attention was drawn by Miss E. H. Phillips, at that time investigating the black smut of figs caused by *Aspergillus niger,* to a particular rot of the fruit of the fig very often found in Calimyrna orchards.[2] The disease has since assumed alarming proportions. The writer has spent the greatest part of his time during the spring, summer and fall of 1923 and 1924 investigating this disease. A preliminary report is considered necessary by the interest aroused in phytopathological circles.

The disease, as far as it is at present known, affects only the fruit of the fig, and while it has been usually confused with souring, it is also known under the names soft rot, pink rot, brown rot, stem end or eye end rot. The symptoms of the disease are not always visible externally, as the disease progresses from the cavity of the fig outwards, the appearance of external symptoms depending on climatic factors and on foci of infection. The external symptoms consist in a more or less extensive watersoaking of the skin accompanied by a more or less bright pink or purple pigment. Such spots may occur principally around the eye or spread on the sides in indefinite areas. The meat and the pulp under such spots are entirely disintegrated, soft and watery, of a yellowish brown color and in many cases of a very offensive putrid odor. The disintegration of the pulp, however, may be found without any external signs whatsoever.

Rotten tissue examined under the microscope is found permeated by a hyaline, frequently branching, septate mycelium of a fungus which can be very easily isolated and which grows luxuriantly on a variety of culture media exhibiting extremely variable cultural characteristics. It fruits abundantly, producing catenulate, short or long, tapering or slightly curved, unicellular conidia on simple or branched conidiophores borne on the sides of the hyphae. The fungus has been tentatively identified as *Oospora verticillioides* Sacc.[3] Numerous inoculation tests have shown that this fungus is the cause of the disease.

A study of the distribution of this disease through the fig belt of California revealed the fact that the fungus is spread throughout the fig-growing sections of California, being found in both the San Joaquin and Sacramento valleys and in Southern California. It was also found that the disease is present only in fruit of the Calimyrna variety, or other caprified figs. The Calimyrna is the chief variety that requires caprification, and this has directed attention to the caprifying insect, *Blastophaga psenes* L. (*Blastophaga grossorum* Grav.). Plates poured from the pulp of the winter crop of Caprifigs (Mamme), showed the presence of the same fungus as well as a red or white bacterium which is also associated with the rot. This bacterium has been tentatively identified as *Bact. prodigiosus,* and while it undoubtedly contributes to the symptoms, it does not produce the disease when inoculated into figs.

An investigation of the flora of caprifigs and edible figs both green and ripe and their succession of crops was then undertaken and the results may be here summarized as follows:

[1] Pierce, N. B., "Investigations of the special agent in California." In Report Sec. Agr. U. S. D. A. 1892: 238. 1893.

[2] The Calimyrna variety is the Lob Indjir Variety of Smyrna grown in California.

[3] Cultures sent to Miss Nellie A. Brown, pathologist, Laboratory of Plant Pathology, U. S. D. A., Washington, D. C., were found producing septate, fusarium-like spores; the fungus has been identified by Dr. Sherbakoff as *Fusarium moniliforme* Sheld.

1. Fruit of parthenocarpic varieties is sterile until the loosening of the scales and the opening of the eye, when they remain sterile unless visited by insects (*Carpophilus hemipterus* L., *Notoxus constrictus* Casey, *Drosophila ampelophaga* Loew., etc.).

2. Fruit of caprified varieties is sterile previous to caprification. Fruit of caprifigs is sterile until caprified.

3. A definite flora, as mentioned previously, has been persistently found in caprified edible figs and caprifigs, irrespective of the kind of the crop (Mamme, Profichi, Mammone.).

4. The spores of the fungus have been obtained from Blastophaga caught under sterile conditions as they were issuing from caprifigs.

A microscopic examination of the wings and other appendages of Blastophaga showed the spores of the fungus lodged in considerable numbers among the spines of the wings, where they germinated under proper conditions. The question then arose as to where the fungus vegetates and where it grows from the time it is introduced into the fig cavity until the signs of the rot begin. Cultural and microscopical examinations of individual gall flowers taken from caprifigs show that the spores of the fungus germinate readily and grow on the stigma and the style of the flowers and on the body of the dead insect until the new generation of Blastophaga is ready to emerge. At that time there are enough spores in the cavity and these adhere to the bodies of the female insects which carry them into the cavity of the edible figs. As a rule, a number of spores are carried on the body of the Blastophaga and are deposited by it on the stigma of the flowers as the insect wanders among them in a vain attempt to oviposit. The spores germinate there and grow slowly on the stigma until the fig begins to ripen and soften. The fungus is then able to invade the tissues rapidly, producing the symptoms described previously. In some cases, when the spores of the fungus are carried on the wings, a dry rot is produced on the eye end of the fig, because usually the wings of the Blastophaga are caught among the scales of the eye. A similar rot results when a number of insects are lodged among these scales in instances of overcaprification, because under these circumstances the fungus is able to grow on the bodies of the Blastophaga until the fig tissues are invaded.

This investigation is a part of the general study of fig diseases carried on in this laboratory under the direction of Professor R. E. Smith.

PANOS D. CALDIS

UNIVERSITY OF CALIFORNIA
LABORATORY OF PLANT PATHOLOGY

THE ROYAL SOCIETY OF CANADA

SECTION V—BIOLOGICAL SCIENCES

THE annual meeting of the Royal Society of Canada was held in Ottawa on May 18, 19, 20 and 21. The following papers were presented in Section V:

Presidential Address

Proteolysis and the structure of proteins: ANDREW HUNTER.

Zoological

Marine wood borers in British Columbia waters: C. MCLEAN FRASER.

The histology of the "colon" and its contained spiral valve of the Pacific dogfish (Squalus sucklii) with an investigation of the phylogeny of intestinal valves: A. R. FEE (presented by C. McLean Fraser).

Observations on the spruce budworm, Cacoecia fumiferana Clem: ARTHUR GIBSON.

The Ephemeroptera of Covey Hill, Quebec: J. MCDUNNOUGH (presented by Arthur Gibson).

Revision of the American species of the Tachinid Genus Peleteria (Diptera): C. H. CURRAN (presented by Arthur Gibson).

A preliminary revision of some Charopsinae, a subfamily of Ichneumonoidea of Ichneumon flies: HENRY L. VIERECK (presented by Arthur Gibson).

Losses in trout fry after distribution in streams: A. P. KNIGHT and H. C. WHITE (presented by A. P. Knight).

A preliminary study of the respiratory exchange in Grylloblatta campodeiformis E. Walker: NORMA FORD (presented by E. Walker).

Northern Cyclopidae and Canthocaptidae: ARTHUR WILLEY.

A new gill-parasite of pike-perches in northern lakes: JEAN T. HENDERSON (presented by Arthur Willey).

Medical

The action of Collip's parathyroid extract on blood and cerebrospinal fluid calcium: A. T. CAMERON and V. H. K. MOOREHOUSE.

Note on the action of parathyroid extracts on Guanidine: F. D. WHITE and A. T. CAMERON.

A note on tetany in thyroid-fed rats and the supposed antagonism between thymus and parathyroid: A. T. CAMERON and J. CARMICHAEL.

The excretion of water and of gas by frogs submerged in water: A. T. CAMERON and D. ROY MCCULLAGH.

The cranio-facial axis of Huxley: JOHN CAMERON.

Skin susceptibility to toxic filtrates of S. Haemolyticus in convalescents, actively immunized and normal individuals: D. T. FRASER and A. H. GRAHAM (presented by J. G. Fitzgerald).

Some factors concerned in the preparation of diphtheria toxoid: P. J. MOLONEY and C. B. WELD (presented by J. G. Fitzgerald).

The Ramon test. Diphtheria toxin—antitoxin—flocculation: P. J. MOLONEY and C. B. WELD (presented by J. G. Fitzgerald).

Some chemical properties of diphtheria toxoid: P. J.

MOLONEY and C. B. WELD (presented by J. F. Fitzgerald).

Technique of fractional analysis in bacterial fermentations: E. GORDON YOUNG (presented by A. B. Macallum).

Recent observations, by X-rays, on the functional form-changes of the human bronchial tree: CHARLES C. MACKLIN.

The family tree of a case of peroneal atrophy: M. THURLOW MACKLIN and J. THORNLEY BOWMAN (presented by Charles C. Macklin).

The oestrus cycle in the mare and some associated phenomena: E. SEABORN (presented by Charles C. Macklin).

The sugar of the blood and the glycogen of the liver and muscles in standard white rats: LADISLAV KARCZAG, J. J. R. MACLEOD and M. D. ORR.

Some factors influencing the action of insulin and the effects of its daily injections in normal animals: J. MARKOWITZ, M. K. O'BRIEN and M. D. ORR (presented by J. J. R. Macleod).

The time relationship of the changes which occur in the blood as the result of the injection of insulin in depancreatized animals: I. L. CHAIKOFF, J. J. R. MACLEOD and J. MARKOWITZ.

Metabolism during pregnancy in a depancreatized dog kept alive with insulin: J. MARKOWITZ and W. W. SIMPSON (presented by J. J. R. Macleod).

Insulin and tissue reductase: J. MARKOWITZ (presented by J. J. R. Macleod).

The preparation, physiological properties and method of standardization of a parathyroid hormone: J. B. COLLIP and E. P. CLARK (presented by J. J. R. Macleod).

The effects of parathyrin on dogs and other animals and the influence of diet on these effects: J. J. R. MACLEOD and N. B. TAYLOR.

The action of insulin on the blood sugar of the fowl: J. MARKOWITZ (presented by J. J. R. Macleod).

The influence of insulin on asphyxial glycogenolysis: I. L. CHAIKOFF (presented by J. J. R. Macleod).

Lymphatics of the heart: S. G. CHALK (presented by Paul S. McKibben).

Viscero-motor reflexes III: FREDERICK R. MILLER and R. A. WAUD.

Decerebrate rigidity in young mammals: N. B. LAUGHTON (presented by Frederick R. Miller).

Natural arrest of hemorrhage from a wound: JOHN TAIT.

The spindle-cells in relation to coagulation of frog's blood: F. GREEN and JOHN TAIT.

The rôle of platelets in mammalian blood coagulation: H. E. BURKE and JOHN TAIT.

The injection of quartz particles into the blood stream: A. R. ELVIDGE and JOHN TAIT.

Some points in relation to the structure and function of the spleen: M. F. CASHIN and JOHN TAIT.

Immunity technique applied to the intergraftability of plants: F. GREEN (presented by John Tait).

Experiments on the labyrinth of frogs: W. J. MCNALLY and JOHN TAIT.

Cause of death in mammals by lowering of body temperature: G. L. CASSIDY (presented by John Tait).

Relation between volume and diameter of mammalian red blood corpuscles: W. F. EMMONS (presented by John Tait).

The effect of temperature upon the rate of action of insulin in mammals: C. J. CASSIDY, S. DWORKIN and W. H. FINNEY (presented by John Tait).

Thermotactic action of insulin: C. J. CASSIDY, S. DWORKIN and W. H. FINNEY (presented by John Tait).

Botanical

Experiments on sex with mushrooms and toadstools: A report on the work of Irene Mounce, William F. Hanna and Dorothy E. Newton: A. H. REGINALD BULLER.

Fern Rusts. I. The genus Milesina: J. H. FAULL, E. H. MOSS, L. M. HUNTER and W. R. WATSON.

Bacterial content of salt water fish: F. C. HARRISON.

Further studies on the saltation of the black dot organism: B. T. DICKSON (presented by F. C. Harrison).

Vermicularia v. Colletotrichum: B. T. DICKSON (presented by F. G. Harrison).

Tomato streak: B. T. DICKSON and T. C. VANTERPOOL (presented by F. C. Harrison).

A comparative study of lateral and scaliform conjugation in spirogyra: FRANCIS E. LLOYD.

Chromosome numbers and plant characters in hybrids between durum and bread wheats: W. P. THOMPSON.

Cytological conditions in wheat-rye hybrids: W. B. THOMPSON.

The uredinales of the prairie provinces of Canada: W. P. FRAZER and I. L. CONNERS (presented by W. P. Thompson).

Net blotch of barley—Helminthosporium teres Sacc: MARGARET NEWTON (presented by W. P. Thompson).

Some features of the primary resin canals of the conifers: CHARLES S. HANES (presented by R. B. Thomson).

PAUL S. MCKIBBEN
UNIVERSITY OF WESTERN ONTARIO

THE WESTERN PSYCHOLOGICAL ASSOCIATION

THE fifth annual meeting of the Western Psychological Association was held at University of California, Berkeley, on July 24 and 25. The Association officers for 1924–25 are: Arthur H. Sutherland, president, Los Angeles; Raymond H. Franzen, vice-president, University of California; Walter R. Miles, secretary-treasurer, Stanford University; Edward C. Tolman, local committeeman, University of California. The following papers were presented:

FRIDAY, JULY 24

9:30 A. M.

Ideomotor action and dynamogenesis: HERBERT S. LANGFELD, Princeton University.

AUG 24 1925